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Master of Design (Research) Thesis

## **Breathing life into pursed lip breathing and the implications of designing a product**

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## **Certificate of Original Authorship**

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Elizabeth Lewis

Date: 16<sup>th</sup> December 2016



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## Definitions

**Chronic Obstructive Pulmonary Disease (COPD):** is a long term disease of the lungs which causes shortness of breath.

**Comorbid:** the presence of one or more additional diseases or disorders simultaneous to a primary disease or disorder.

**Entrainment:** the patterning of body processes and movement to rhythm.

**Feedback:** process in which the effect or result of an action is returned or 'fed back' so that the next action can be modified. It is information sent to an entity, be it mechanical, electrical or biological, about its prior behaviour so that the entity can adjust current and future behaviour to achieve a desired result.

**Functional capacity:** the ability of an individual to perform aerobic activities. The assessment of functional capacity reflects the ability to perform activities of daily living that require sustained aerobic metabolism.

**Harmonica Therapy:** rehabilitation sessions that are performed in a group and require patients play the harmonica.

**Monitoring:** to be aware of the state of a system or situation, to observe for changes over a period of time and to report progress.

**Motivation:** a reason for an individual to behave in a particular way.

**Patient interface:** the position where interactions between humans and products take place. The goal of the interaction is to allow for effective operation and control by the patient, whilst the product provides information that aids the patient in using the product. The type of interface can range greatly and includes digital, manual, visual, audio and tactile elements.

**Pathophysiology:** physical and functional changes associated with a disease.

**Pharmacology:** the properties and reactions of drugs or medication especially with relation to their therapeutic value.



**Psychosocial:** relates to an individual's psychological development or change within a social environment.

**Pulmonary rehabilitation:** evidence based, multidisciplinary and comprehensive intervention for patients with chronic respiratory disease who exercise symptoms and often have decreased daily life activities.

**Pursed Lip Breathing (PLB):** is a breathing technique which focuses on the lengthening of the expiration of breath versus the inspiration of breath

**Self-efficacy:** an individual's belief in their capacity to perform behaviours that are required to achieve specific performance requirements.

**Self-management:** an individual's ability to manage the symptoms, treatment, physical and psychosocial consequences and lifestyle changes inherent in living with a chronic illness.

**Six-minute walking test:** a test that measures the distance that patients are able to walk on a hard flat surface over a six-minute period.

**Smartphone:** a mobile phone that performs many of the functions of a computer. Typically possesses a touchscreen interface, camera, Internet access and an operating system capable of running downloaded applications and programs.

**Spacer:** a plastic container with a mouthpiece at one end and a hole for a canister of medication at the other. The plastic container adds space in the form of a chamber between the canister of medication and the patient's mouth, allowing the patient to inhale the medication slowly.

**Spirometry:** a diagnostic tool that measures the volume of air that can be forcibly exhaled within a specific time period.

**Tidal volume:** the lung volume representing the normal volume of air displaced between normal inhalation and exhalation when extra effort is not applied.

## Abstract

Pursed Lip Breathing (PLB) is one of the many management techniques used by patients suffering from Chronic Obstructive Pulmonary Disease (COPD). Implementation of this technique aims to reduce a patient's feeling of breathlessness and restore a sense of breathing control. Although PLB is widely taught, there is still much unknown about how best to teach the PLB technique and how expert PLB users become skilled. A potential solution is the development of a personal device that guides patients to achieve improved paced breathing whilst simultaneously collecting valuable information for the clinical setting.

This work investigates the characteristics of a product for COPD patients to independently manage their breathlessness by using paced breathing principles. Interviews were conducted with COPD patients to identify rituals, attitudes and learning methods regarding PLB, as well as thoughts on existing respiratory aids and technologies. Findings from these interviews were categorised into 5 themes; monitoring and feedback, adaption, routine, motivation and active learning.

Based on these findings design characteristics were established and a proof-of-concept developed and preliminarily tested to demonstrate that its core features can be realised. These features include breath-by-breath data acquisition, real-time visual feedback during breathing practice and the capacity for remote monitoring by respiratory therapists. The results of this work indicate that paced breathing can be monitored and shared with patients and that incremental targets for improved performance can be set. It is intended that the outcomes of this work will help facilitate future research into COPD management techniques, reveal future product development opportunities and enable sufferers of COPD to improve their quality of life.